

**OREGON COASTAL NONPOINT PROGRAM**  
**NOAA/EPA PROPOSED FINDING**  
**Draft 10/9/14**

**C. ADDITIONAL MANAGEMENT MEASURES - FORESTRY**

**PURPOSE OF MANAGEMENT MEASURE:** The purpose of this management measures is to identify additional management measures necessary to achieve and maintain applicable water quality standards and protect designated uses for land uses where the 6217(g) management measures are already being implemented under existing nonpoint source programs but water quality is still impaired due to identified nonpoint sources.

**CONDITION FROM JANUARY 1998 FINDINGS:** Within two years, Oregon will identify and begin applying additional management measures where water quality impairments and degradation of beneficial uses attributable to forestry exist despite implementation of the 6217(g) measures.

**PROPOSED FINDING:**

*(This finding is for all the additional management measures for forestry, not just pesticides. I'm leaving this blank.)*

**RATIONALE:**

The federal agencies' January 13, 1998, conditional approval findings noted that Oregon had published forest practices rules that require buffer zones for most pesticide applications (OAR 629-620-0400(7)(b)). However, these rule changes did not address aerial application of herbicides along non-fish bearing streams. NOAA and EPA determined that stream spray buffers for the aerial application of herbicides on non-fish bearing streams on forestlands was inadequate and should be strengthened to attain water quality standards and fully support beneficial uses.

Since its 1998 conditional approval findings, Oregon has provided several documents further describing the programs it relies on to manage pesticides, most recently in March 2014. In addition to the FPA rule buffers noted above, the state also addresses pesticide issues through the Chemical and Other Petroleum Product Rules (OAR 629-620-0000 through 800), Pesticide Control Law (ORS 634), best management practices set by the ODA, and federal pesticide label requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as well as the State's Water Quality Pesticide Management Plan and Pesticide Stewardship Partnership. In its March 2014 submittal, Oregon noted that it specifically relies on best management practices set by ODA and EPA under FIFRA for the protection of small non-fish bearing streams. Given the lack of monitoring for aerial application of herbicides on non-fish bearing streams in Oregon's coastal forestlands and the potential for adverse water quality and designated use impacts from the aerial application of herbicides, NOAA and EPA continue to believe that Oregon should take additional steps to ensure non-fish bearing streams are adequately protected during the aerial application of herbicides.

Aerial application of herbicides, such as glyphosate, 2,4-D, atrazine, and others, is a common practice in the forestry industry. Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. Within the coastal nonpoint management area, non-fish bearing streams comprise 60 to 70 percent of the total stream length. Oregon does not require riparian buffers during forest harvests along non-fish bearing streams, which might otherwise provide a defacto spray buffer. Furthermore, there are no riparian buffers to filter herbicide-laden runoff before it enters the streams.

In the NOAA National Marine Fisheries Services' (NMFS) biological opinion (BiOp) for several EPA herbicide labels, including 2,4-D, aerial drift was identified as the most likely pathway for these herbicides to enter aquatic habitats.<sup>1</sup> NMFS also noted that runoff was also a likely pathway for 2,4-D. The BiOp states that herbicides can have both direct and indirect effects on water quality and aquatic species, including salmon. One of the common indirect effects occurs because herbicides can reduce the growth and biomass of primary producers (algae and phytoplankton) that form the base of the aquatic food chain. The BiOp notes that a decrease in primary production can have significant effects on consumers that depend on the primary producers for food. These effects are often reported at herbicide concentrations well below concentrations that would have a direct effect on consumers. The BiOp discusses that it is difficult to predict the magnitude and duration these impacts would have on juvenile salmon because the extent of salmonid effects often depend on the interaction with many different parameters, such as availability of alternative food sources, water temperature, and other abiotic factors. NMFS concluded that products containing 2,4-D are likely to jeopardize the existence of all listed salmonids and adversely modify or destroy critical habitat. NMFS also concluded that products containing diuron, another common herbicide used by the forestry industry, were also likely to adversely modify or destroy critical habitat, but not likely to jeopardize listed salmonids.

Research has shown that the aerial application of herbicides may adversely impact water quality and salmon. As discussed in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, Norris and Moore (1971) found that the most adverse effects from the application of pesticides (including herbicides) occur when they are applied directly to water.<sup>2</sup> Direct application can occur by spraying pesticides directly over streams and through aerial drift. Norris and Moore also observed the concentration of 2,4-D in streams was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers.

There have been few peer-reviewed studies that have specifically evaluated the extent and effects of aerial application of herbicides in Oregon's coastal nonpoint management area and none on

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<sup>1</sup> NMFS. 2011. *National Marine Fisheries Service Endangered Species Act Section 7 Consultation Biological Opinion Environmental Protection Agency Registration of Pesticides 2,4-D, Triclopyr BEE, Diuron, Linuron, Captan, and Chlorothalonil*. NOAA National Marine Fisheries Service, June 30, 2011.

<sup>2</sup> EPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 840-B-92-002 January 1993.

non-fish bearing streams. The non-peer reviewed studies that are available, such as ODF's analysis of aerial pesticide application on Type F (fish bearing) and Type D (drinking water)<sup>3</sup> and monitoring results from the Alsea paired watershed study<sup>4</sup> focused largely on impacts to fish-bearing streams. These studies reported that herbicide concentrations in the streams were below exposure thresholds of concern for human and aquatic life. However, because they did not sample non-fish bearing streams which lack spray and riparian buffers, the same conclusion cannot be drawn about non-fish streams. The Alsea paired watershed study, which included a sample site at the interface of the fish/non-fish bearing comes the closest to assessing the impact of aerial application over non-fish bearing streams but the study still did not include a sample site from a non-fish bearing stream in the middle of the spray zone.

Other studies, such as a USGS study along the McKenzie River of the Clackamas Basin<sup>5</sup> (outside the coastal nonpoint management area) and the Oregon Health Authority's (OHA) Exposure Investigation along the Highway 36 Corridor<sup>6</sup> looked more broadly at pesticide use and did not focus on impacts from the aerial application of herbicides along non-fish bearing streams. Similar to the ODF and Alsea studies, the USGS study, which looked at urban, forestry, and agricultural pesticide uses, did not detect any pesticides in samples taken from drinking water intakes at levels of concern. Because the study was not designed to specifically observe impacts due to aerial application, the sampling was not timed to capture spray events. The OHA study was designed to look more broadly at pesticide, including herbicide exposure. The researchers detected herbicides in blood and urine samples from humans. Low levels of herbicides that were applied aurally were also found in 10 soil samples, but no herbicides were found in drinking water samples. However, the study acknowledges that herbicide samples were not collected during the primary time of spraying. Therefore, the findings likely do not reflect peak pesticide levels and potential exposures.

Oregon asserts it relies on the national best management practices established through the federal FIFRA pesticide labels to protect non-fish bearing streams. Currently, EPA, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture are working to improve the national risk assessment process to include all Endangered Species Act-listed species when registering all pesticides, including herbicides. Given the scale of this undertaking, the federal agencies are employing a phased, iterative approach over the next 15 years to make the changes, and it is expected that herbicide labels will not be updated until the end of the 15-year process. This ongoing federal process, however, should not preclude Oregon from making needed state-level improvements to how it manages herbicides in the context of its forestry landscape and sensitive species.

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<sup>3</sup> Dent L. and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7. March 2000.

<sup>4</sup> NCAIS (2013) [full citation but I haven't been able to access this report]

<sup>5</sup> Kelly et al., 2012 [provide full citation]

<sup>6</sup> Oregon Health Authority, Draft Final, 2014 [provide full citation]

Oregon and other Pacific Northwest states have recognized the need to go beyond the national FIFRA label requirements to protect water quality and aquatic species, including salmon, in their state. Oregon has 60-foot spray buffers for non-biological insecticides and fungicides on non-fish bearing streams (OAR 629-620-400(7)) and 60-foot spray buffers for herbicides on wetlands, fish-bearing and drinking water streams (OAR 629-620-400(4)). Compared to neighboring coastal states and jurisdictions, Oregon has the smallest forestry-specific water resource buffers for herbicides on non-fish bearing streams. For smaller non-fish bearing streams, Washington maintains a 50-foot riparian and spray buffer (WAC-222-38-040). Idaho has riparian and spray buffers for non-fish bearing streams of 100 feet (IAR 20-02-01). California has riparian buffers for non-fish bearing streams (\*\*), which implicitly restrict the aerial application of herbicides near the stream.

With a lack of information about the specific impacts of herbicide spraying over non-fish bearing streams in Oregon and the scientific literature that shows a potential for negative effects, Oregon should ensure that it is providing adequate protections for non-fish bearing streams associated with the aerial application of herbicides.

Oregon has taken many steps in this direction such as instituting a training and licensure program for applicators, creating an ODF notification form prior to application, developing a Water Quality Pesticide Management Plan, and piloting a Pesticide Stewardship Program. ODF works with ODA to require pesticide applicators to undergo training and obtain licenses prior to being allowed to spray pesticides. Part of the training includes a review of the regulations and requirements for protecting streams during aerial application. To reduce aerial drift, Oregon has guidance that instructs applicators to consider temperature, relative humidity, wind speed, and wind direction. In addition to the training program and guidance, ODF requires all pesticide applicators to complete a notification form and submit to ODF for approval prior to spraying. On the form, applicators must indicate the potential pesticides that may be applied, the stream segments within the application site, and the window of time in which application may occur. The notification also includes a reminder of the spray buffers for fish-bearing and drinking water streams that may apply. While ODF's notification form specifically identifies guidance on spray buffers in the FPA, it is silent on Type N streams, presumably relying on FIFRA regulations. ODF's notification form allows a full list of pesticides that the applicator may use, so it is difficult to determine which pesticide will be and is actually applied. Oregon agencies also regularly coordinate through the

In 2007, key state agencies, including ODA, ODF, ODEQ, and the Oregon Health Authority, worked together to develop an interagency Water Quality Pesticide Management Plan to guide State-wide and watershed-level actions to protect surface and groundwater from potential impacts of pesticides, including herbicides. The plan, approved by EPA Region 10 in 2011, focuses on using water quality monitoring data as the driver for adaptive management actions. The plan describes a continuum of management responses, ranging from voluntary to regulatory actions the state could take to address pesticide issues. If water quality concerns cannot be

addressed through the collaborative, interagency-effort, regulatory actions are taken using existing agency authorities.

As outlined in the plan, the State's Pesticide Stewardship Partnership (PSP) Program is the primary mechanism for addressing pesticide water quality issues at the watershed level. Through the partnership, the ODEQ works with State and local partners to collect and analyze water samples and use the data to focus technical assistance and best management practices on streams and pesticides that pose a potential aquatic life or human health impact.

NOAA and EPA acknowledge the steps the State has already taken to help reduce water quality impacts during the aerial application of herbicides over non-fish bearing streams. However, the guidance and notification procedures do not directly speak to protecting non-fish bearing streams. In addition, the water quality monitoring data on pesticides is still limited in the State. Oregon has only established eight PSP monitoring areas in seven watersheds, none of which are within the coastal nonpoint management area. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds, and Oregon received recent funding to expand into two new watersheds, the agencies believe that if monitoring data are to drive adaptive management, the State should develop and maintain more robust and targeted studies of the effectiveness of its pesticide monitoring and best management practices within the coastal nonpoint management area. Moreover, the federal agencies encourage the State to design its monitoring program in consultation with EPA and NMFS so that it generates data that are also useful for EPA pesticide registration reviews and NMFS biological opinions that assess the impact of EPA label requirements on listed species.

In addition to a more robust, overall monitoring program for herbicides and other pesticides and to fully address the concerns NOAA and EPA raised in the 1998 conditional approval findings, Oregon may be able to achieve greater protection of non-fish bearing streams during the aerial application of herbicides through regulatory or voluntary approaches. An example of a regulatory approach would be to institute spray buffers for the aerial application of herbicides along non-fish bearing streams similar to neighboring states. Another option would be to institute riparian buffers along non-fish bearing streams, which, by default, would also provide a buffer during the aerial application.

Oregon could also institute voluntary programs, backed by enforceable authorities. These voluntary efforts could build on existing programs. Elements of the voluntary program could include:

- Develop more specific guidelines for voluntary buffers or buffer protections for the aerial application of herbicides on non-fish bearing streams. For example, require (or encourage?) the use of GPS technology, linked to maps of non-fish bearing streams, to automatically shut off nozzles before crossing non-fish bearing streams.

- Educate and train aerial applicators of herbicides on the new guidance and how to minimize aerial drift to waterways, including non-fish bearing streams, and surrounding communities;
- Revise the ODF notification form to include a check box for aerial applicators to indicate they must adhere to FIFRA labels for all stream types, including non-fish bearing streams;
- Track the implementation of voluntary measures for the aerial application of herbicides along non-fish bearing streams and assess the effectiveness of these practices to protect water quality and designated uses;
- Conduct direct compliance monitoring for FIFRA label requirements related to aerial application of herbicides in forestry;
- Provide better maps of non-fish bearing streams and other sensitive sites and structures to increase awareness of these sensitive areas that need protection among the aerial applicator community; and

If Oregon chooses a voluntary approach, the state would also need to meet the other CZARA requirements for using a voluntary, incentive-based programs as part of the state's coastal nonpoint program. This includes describing the process the state will use to monitor and track implementation of the voluntary practices, providing a legal opinion stating it has the necessary back-up authority to require implementation of the voluntary measures, and demonstrating a commitment to use that back-up authority.

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**Comment [JW1]:** I'll add all citations in the endnote format by October 20.

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**RATIONALE:**

The federal agencies' January 13, 1998, conditional approval findings noted that Oregon had published forest practices rules that require buffer zones for most pesticide applications (OAR 629-620-0400(7)(b)). However, these rule changes did not address aerial application of herbicides along non-fish bearing streams. NOAA and EPA determined that stream spray buffers for the aerial application of herbicides on non-fish bearing streams on forestlands was inadequate and should be strengthened to attain water quality standards and fully support beneficial uses.

Since its 1998 conditional approval findings, Oregon has provided several documents further describing the programs it relies on to manage pesticides, most recently in March 2014. In addition to the FPA rule buffers noted above, the state also addresses pesticide issues through the Chemical and Other Petroleum Product Rules (OAR 629-620-0000 through 800), Pesticide Control Law (ORS 634), best management practices set by the ODA, and federal pesticide label requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as well as the sState's Water Quality Pesticide Management Plan and Pesticide Stewardship Partnership. In its March 2014 submittal, Oregon noted that it specifically relies on best management practices set by ODA and EPA under FIFRA for the protection of small non-fish bearing streams. Given the lack of monitoring for aerial application of herbicides on non-fish bearing streams in Oregon's coastal forestlands and the potential for adverse water quality and designated use impacts from the aerial application of herbicides, NOAA and EPA continue to believe that Oregon should take additional steps to ensure non-fish bearing streams are adequately protected during the aerial application of herbicides.

**Comment [LL2]:** Not sure what BMPs set by EPA means. Do you mean label directions? --JW, this is verbatim from the State's comments.

**Comment [AC3]:** I like this language change.

Aerial application of herbicides, such as glyphosate, 2,4-D, atrazine, and others, is a common practice in the forestry industry. Herbicides are sprayed to control weeds on recently harvested parcels to prevent competition with newly planted tree saplings. Within the coastal nonpoint management area, non-fish bearing streams comprise 60 to 70 percent of the total stream length. Oregon does not require riparian buffers during forest harvests along non-fish bearing streams, which might otherwise provide a defacto spray buffer. Furthermore, there are no riparian buffers to filter herbicide-laden runoff before it enters the streams.

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**Comment [AC4]:** I only looked at BiOp that included 2,4-D. Would be good to skim the others for herbicides and make sure the same conclusions are made or acknowledge differences.

*JW: I looked at the other BiOp for herbicides, May 2012. But the three herbicides are not authorized for forestry. So I think it's just the 2011 BiOps for 2,4 D and others that we can rely on.*

**Comment [AC5]:** Good. That makes things easier.

**Comment [AC6]:** I'm assuming this is true.

Research has shown that the aerial application of herbicides may adversely impact water quality and salmon. As discussed in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, the condition for forest chemical management is to "use chemicals when necessary for forest management in accordance with the following to reduce nonpoint source pollution impacts due to the movement of forest chemicals off-site during and after application: (4) Establish and identify buffer areas for surface waters. (This is especially important for aerial applications.)" EPA's 1993 *Guidance* cites a study from Norris and Moore (1971) found that the most adverse effects from the application of pesticides (including herbicides) occur when they are applied directly to water.<sup>2</sup> Direct application can occur by spraying pesticides directly over streams and through aerial drift. Norris and Moore also

**Comment [AC7]:** As I stated before, I don't think we should bring this up here. We're talking about an add MM, not a standard CZARA MM, which we say OR has already met. Introducing the standards CZARA MM lang now, I feel, only confuses things.

<sup>1</sup> NMFS. 2011. *National Marine Fisheries Service Endangered Species Act Section 7 Consultation Biological Opinion Environmental Protection Agency Registration of Pesticides 2,4-D, Triclopyr BEE, Diuron, Linuron, Captain, and Chlorothalonil*. NOAA National Marine Fisheries Service, June 30, 2011.

<sup>2</sup> EPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA 840-B-92-002 January 1993.



observed the concentration of 2,4-D in streams was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers. Norris and Moore (1971) that observed the concentration of 2,4-D in streams was one to two orders of magnitude higher in forestry operations without buffers than in areas with buffers. Riekirk and others (1989) found that the greatest risk to water quality from forestry pesticide application was from aerial application and drift, runoff, and erosion. In Norris (1967), glyphosate aerially applied in the Oregon Coast Range with no buffers and direct application resulted in a maximum stream concentration of 0.27 mg/L.

There have been few peer-reviewed studies that have specifically evaluated the extent and effects of aerial application of herbicides in Oregon's coastal nonpoint management area and none on non-fish bearing streams in Oregon's coastal nonpoint management area. The non-peer reviewed studies that are available, such as ODF's analysis of aerial pesticide application on Type F (fish bearing) and Type D (drinking water)<sup>3</sup> and monitoring results from the Alsea paired watershed study<sup>4</sup> focused largely on impacts to fish-bearing streams. These studies reported that herbicide concentrations in the streams were below exposure thresholds of concern for human and aquatic life. However, because they did not sample non-fish bearing streams which lack spray and riparian buffers, the same conclusion cannot be drawn about non-fish streams. The Alsea paired watershed study, which included a sample site at the interface of the fish/non-fish bearing comes the closest to assessing the impact of aerial application over non-fish bearing streams but the study still did not include a sample site from a non-fish bearing stream in the middle of the spray zone.

Other studies, such as a USGS study along the McKenzie River of the Clackamas Basin<sup>5</sup> (outside the coastal nonpoint management area) and the Oregon Health Authority's (OHA) Exposure Investigation along the Highway 36 Corridor<sup>6</sup> looked more broadly at pesticide use and did not focus on impacts from the aerial application of herbicides along non-fish bearing streams. Similar to the ODF and Alsea studies, the USGS study, which looked at urban, forestry, and agricultural pesticide uses, did not detect any pesticides in samples taken from drinking water intakes at levels of concern. Because the study was not designed to specifically observe impacts due to aerial application, the sampling was not timed to capture spray events. The OHA study was designed to look more broadly at pesticide, including herbicide exposure. The researchers detected herbicides in blood and urine samples from humans. Low levels of herbicides that were applied aerially were also found in 10 soil samples, but no herbicides were found in drinking water samples. However, the study acknowledges that herbicide samples were not collected during the primary time of spraying. Therefore, the findings likely do not reflect peak pesticide levels and potential exposures.

<sup>3</sup> Dent L. and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry. Pesticides Monitoring Program. Technical Report 7. March 2000.

<sup>4</sup> NCAIS (2013) [full citation but I haven't been able to access this report]

<sup>5</sup> Kelly et al., 2012 [provide full citation]

<sup>6</sup> Oregon Health Authority. Draft Final. 2014. [provide full citation]

**Comment [AC8]:** Conc. may be higher but was it at levels known to cause impairments? We should find that out. – *There aren't really any published threshold values in the section (g) guidance. In articles referred to below, the pesticides detected in the studies are compared to a threshold of concern determined in those studies, so we compare it there.*

**Comment [AC9]:** I know the (g) guidance didn't include threshold values but what do we think are reasonable toxicity/exposure conc. thresholds based on our knowledge? Do we think the thresholds the other studies cite are good or do we think they have weaknesses, if so, what aren't they considering that could lead to toxicity at lower levels? We need to call that out if we have a problem with the other thresholds being used.

Regardless, we should get our hands on the original N&M 1971 study so we know what the concentrations that were observed, the size buffers, and when samples were taken etc. Need to be prepared to defend ourselves if anyone picks on that study.

**Comment [AC10]:** This is very old. I don't think it adds anything since it is pre-spray buffer era. Especially since we have more recent studies, based on current BMPs

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**Comment [AC11]:** State submission and several commenters also discussed USGS study for Eugene Drinking water District. We should acknowledge that as well.

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**Comment [AC12]:** Did they only measure drinking water samples or did they test streams as well? Did they measure herbicides above toxic thresholds at any other sites?

**Comment [AC13]:** Is this true? I haven't read the study but recall some summary to this effect but perhaps I'm mixing up my studies.

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Studies in Oregon have found positive detections in water after aerial application (Dent and Robben, 2000; Kelly et al., 2012). These levels have been below thresholds of concern determined in the studies for people and aquatic life. ODF's Dent and Robben 2000 Study monitored herbicides and fungicides along Type F (fish-bearing) and Type D (drinking water) streams to assess the effectiveness of the FPA pesticide management practices at protecting water quality during drift application.<sup>7</sup> Of 26 sites sampled 24 hours after application, all herbicides detected were at concentrations of less than 1 ppb, below the minimum exposure thresholds for humans and aquatic life. They concluded that the FPA's practices were effective at protecting water quality for Types F and D streams. However, they note they could not draw any conclusions about the FPA's effectiveness at protecting water quality for non-fish bearing streams during the aerial application of herbicides. In a 2012 USGS study in the McKenzie River of the Clackamas Basin, outside the coastal zone management area, 43 out of 175 compounds were detected at least once across 28 sites. The study focused on urban, forestry, and agricultural land uses. Nine pesticides were detected out of 14 samples from the drinking water facility's intake from 2002 to 2010. However, concentrations were low, less than 1 part per billion, and the largest number of pesticide detections were associated with urban stormwater (Kelly et al. 2012). This study was conducted outside the coastal zone management area.

Non-peer-reviewed studies also did not focus on aerial application of herbicides on non-fish bearing streams in forestlands. The Oregon Health Authority's Exposure Investigation (EI) on the Highway 36 Corridor included herbicide samples in water, food, plants, and people. While herbicides have been detected in blood and urine samples, it is not possible to confirm whether these exposures resulted from the aerial application of pesticides or from another source. Low levels of herbicides applied during aerial applications were found in 10 soil samples, but no herbicides were found in drinking water samples (Oregon Health Authority, Draft Final, 2014). However, the Study noted that herbicide samples were not collected during the primary time of spraying.

ODF's paired watershed study on the Alsea subbasin also found that while some herbicides were detected, they were not at levels that would pose a significant risk to humans or aquatic life.<sup>8</sup> Following the aerial application of herbicides over a non-fish bearing stream segment that did not have riparian buffers, the researchers measured herbicide concentrations at three locations below the application site: at the fish/non-fish bearing stream interface in the middle of the harvest unit; at the bottom of the harvest unit; and well below the harvest unit. Of the five herbicides that were applied, only glyphosate was detected in any of the samples. An initial pulse of glyphosate, ranging from about 40 to 60 ng/L (ppt), was recorded at the fish/no-fish interface site shortly after spraying but matched concentrations observed at the other two sites (approximately 25 ng/L) after three days. A clear pulse of approximately 115 ng/L (ppt) was recorded at the bottom of the harvest unit during a storm event that occurred eight days after

**Comment [AC14]:** I may be oversimplifying but after thinking some more about how we frame this, perhaps a shorter summary of the key OR studies as suggested above would be more appropriate. Not sure getting into all the nitty-gritty details is needed. We may still want to indicate some of the concentrations observed but didn't have time to work that in.

**Comment [AC15]:** Of what? Be specific of the types of herbicides

**Comment [AC16]:** Use footnotes to include full citations like above.

**Comment [AC17]:** Would be good to figure out how far below this was.

**Comment [AC18]:** The only summaries of this research I've been able to locate are in the state's March submittal and in a slide presentation/abstract at <http://watershedsresearch.org/results/#alsea>. The work has been published by NCASI 2013 but I haven't been able to access the actual report yet. Would like to read through full study to confirm these statements are accurate and provide more specificity to what "well below" means. - JW- got a copy of document and will amend this section.

<sup>7</sup> Dent L. and J. Robben. 2000. *Oregon Department of Forestry: Aerial Pesticide Application Monitoring Final Report*. Oregon Department of Forestry, Pesticides Monitoring Program. Technical Report 7. March 2000.

<sup>8</sup> NCAS (2013) [full citation but I haven't been able to access this report]

application and another clear pulse of approximately 42 ng/L (ppt) was observed at the interface site during a second storm event ten days after spraying. All glyphosate concentrations recorded throughout the study period were orders of magnitude less than what the literature reported as the lowest observable effect for a variety of aquatic species. However, like the earlier ODF assessment, no samples were taken from a non-fish bearing stream segment that was directly under the application site. The water quality impacts to the non-fish bearing stream segment are unknown although one would expect to find higher concentrations of herbicides.

**Comment [JW19]:** I added the articles of the most recent pesticide monitoring efforts in Oregon, though again none of these are for aerial application of herbicides on Type N streams. Allison, is this the kind of info you're looking for, or is it better to consolidate?

**Comment [AC20]:** I think this statement may be true but difficult to tell from the summary info I've been able to find so far. Can someone confirm? -JW  
- will ask Beter.

Oregon asserts it relies on the national best management practices established through the federal FIFRA pesticide labels to protect non-fish bearing streams. Currently, EPA, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture are working to improve the national risk assessment process to include all Endangered Species ActESA-listed species when registering all pesticides, including herbicides. Given the scale of this undertaking, the federal agencies are employing a phased, iterative approach over the next 15 years to make the changes, and it is expected that herbicide labels will not be updated until the end of the 15-year process. This ongoing federal process, however, should not preclude Oregon from making needed state-level improvements to how it manages herbicides in the context of its forestry landscape and sensitive species.

Oregon and other Pacific Northwest states have recognized the need to go beyond the national FIFRA label requirements to protect water quality and aquatic species, including salmon, in their state. Oregon has 60-foot spray buffers for non-biological insecticides and fungicides on non-fish bearing streams (OAR 629-620-400(7)) and 60-foot spray buffers for herbicides on wetlands, fish-bearing and drinking water streams (OAR 629-620-400(4)). Compared to neighboring coastal states and jurisdictions, Oregon has the smallest forestry-specific water resource buffers for herbicides on non-fish bearing streams. For smaller non-fish bearing streams, Washington maintains a 50-foot riparian and spray buffer (WAC-222-38-040). Idaho has riparian and spray buffers for non-fish bearing streams of 100 feet (IAR 20-02-01). California has riparian buffers for non-fish bearing streams (\*\*), which implicitly restrict the aerial application of herbicides near the stream.

**Comment [AC21]:** Riparian or spray? - JW, I think both, but will confirm.

With a lack of information about the specific impacts of herbicide spraying over non-fish bearing streams in Oregon and the scientific literature that shows a potential for negative effects, Oregon ~~needs should to~~ ensure that it is providing adequate protections for non-fish bearing streams associated with the aerial application of herbicides.

Oregon has taken many steps in this direction such as instituting a training and licensure program for applicators, creating an ODF notification form prior to application, developing a Water Quality Pesticide Management Plan, and piloting a Pesticide Stewardship Program. ODF works with ODA to require pesticide applicators to undergo training and obtain licenses prior to being allowed to spray pesticides. Part of the training includes a review of the regulations and requirements for protecting streams during aerial application. To reduce aerial drift, Oregon has guidance that instructs applicators to consider temperature, relative humidity, wind speed, and

**Comment [AC22]:** I think the licensing/training program and guidance has more weight than the form so moved this first.

**Comment [AC23]:** Full name of guidance and cite with a footnote.

wind direction. In addition to the training program and guidance, ODF requires that all pesticide applicators to complete a notification form and submit to ODF for approval prior to spraying. On the form, applicators must indicate the of potential pesticides that may be applied, the stream segments for pesticide application within the application site, and the window of time in which application may occur. The notification also includes, and a reminder of the spray buffers for fish-bearing and drinking water streams that may apply. While ODF's notification form specifically identifies guidance on spray buffers in the FPA, it is silent on Type N streams, presumably relying on FIFRA regulations. ODF's notification form allows a full list of pesticides that the applicator may use, so it is difficult to determine which pesticide will be and is actually applied. ODF also works with ODA to require pesticide applicators to undergo training and obtain licenses prior to being allowed to spray pesticides. Part of the training includes a review of regulations and requirements for protecting streams during aerial application. To reduce aerial drift, Oregon has guidance that instructs applicators to consider temperature, relative humidity, wind speed, and wind direction. For pesticide monitoring, there is currently no monitoring for aerial application of herbicides on non-fish-bearing streams in forestland in the coastal nonpoint management area. However, Oregon plans to increase monitoring pesticides on forestlands in the coastal nonpoint management area. Oregon agencies also regularly coordinate through the

**Comment [AC24]:** I assume precipitation is also included or not? *JW - yes*

**Comment [AC25]:** Is this true. If "approval" is too strong of a word, could we say "review"?

**Comment [AC26]:** I assume this is a correct statement. It seemed odd to say that applicators must indicate a reminder of spray buffers....

**Comment [AC27]:** If I recall what Dirk said though, OR isn't unique in this and that is practice occurs in many states because the applicators simply don't know. If this is a common practice, I don't think we should call it out in OR as a potential problem. Recommend deleting?

**Comment [AC28]:** I assume precipitation is also included or not? *JW - yes*

**Comment [AC29]:** Something is missing. Not sure if it still makes sense to include this statement, if complete or not.

**Comment [AC30]:** This seems disjointed to tack this on here.

Oregon has taken independent steps to further address pesticide water quality issues. In 2007, key state agencies, including ODA, ODF, ODEQ, and the Oregon Health Authority, worked together to develop an interagency Water Quality Pesticide Management Plan to guide State-wide and watershed-level actions to protect surface and groundwater from potential impacts of pesticides, including herbicides. The plan, approved by EPA Region 10 in 2011, focuses on using water quality monitoring data as the driver for adaptive management actions. The plan describes a continuum of management responses, ranging from voluntary to regulatory actions the state could take to address pesticide issues. If water quality concerns cannot be addressed through the collaborative, interagency-effort, regulatory actions are taken using existing agency authorities.

As outlined in the plan, the State's Pesticide Stewardship Partnership (PSP) Program is the primary mechanism for addressing pesticide water quality issues at the watershed level. Through the partnership, the ODEQ works with State and local partners to collect and analyze water samples and use the data to focus technical assistance and best management practices on streams and pesticides that pose a potential aquatic life or human health impact.

NOAA and EPA acknowledge the steps the State has already taken to help reduce water quality impacts during the aerial application of herbicides over non-fish bearing streams. However, the guidance and notification procedures do not directly speak to protecting non-fish bearing streams. In addition, the progress Oregon has made in its establishment of a multi-agency management team, development of its Water Quality Pesticide Management Plan, and implementation of its PSP Program. However, the federal agencies note that water quality monitoring data on pesticides is still limited in the State, and that Oregon has only established eight PSP monitoring areas in seven watersheds, none of which are within the coastal nonpoint

**Comment [AC31]:** I believe this is true but please confirm.

management area. While NOAA and EPA recognize that the PSP program targets the most problematic or potentially problematic watersheds, and Oregon received recent funding to expand into two new watersheds, the agencies believe that if monitoring data are to drive adaptive management, the State should develop and maintain more robust and targeted studies of the effectiveness of its pesticide monitoring and best management practices within the coastal nonpoint management area. Moreover, the federal agencies encourage the State to design its monitoring program in consultation with EPA and NMFS so that it generates data that are also useful for EPA pesticide registration reviews and NMFS biological opinions that assess the impact of EPA label requirements on listed species.

**Comment [LL32]:** We should recognize that Oregon is not randomly selecting watersheds to monitor. – JW- okay

In addition to a more robust, overall monitoring program for herbicides and other pesticides and to fully address the concerns NOAA and EPA raised in the 1998 conditional approval findings, Oregon may be able to achieve greater protection of non-fish bearing streams during the aerial application of herbicides through regulatory or voluntary approaches. An example of a regulatory approach would be to institute spray buffers for the aerial application of herbicides along non-fish bearing streams similar to neighboring states. Another option would be to institute riparian buffers along non-fish bearing streams, which, by default, would also provide a buffer during the aerial application.

Oregon could also institute voluntary programs, backed by enforceable authorities. These voluntary efforts could build on existing programs. Elements of the voluntary program could include, but is not limited to the following:

- Develop more specific guidelines for voluntary buffers or buffer protections for the aerial application of herbicides on non-fish bearing streams. For example, require (or encourage?) the use of GPS technology, linked to maps of non-fish bearing streams, to automatically shut off nozzles before crossing non-fish bearing streams.
- Educate and train aerial applicators of herbicides on the new guidance and how to minimize aerial drift to waterways, including non-fish bearing streams, and surrounding communities;
- Revise the ODF notification form to include a check box for aerial applicators to indicate they must adhere to FIFRA labels for all stream types, including non-fish bearing streams;
- Track the implementation of voluntary measures for the aerial application of herbicides along non-fish bearing streams and assess the effectiveness of these practices to protect water quality and designated uses;
- Conduct direct compliance monitoring for FIFRA label requirements related to aerial application of herbicides in forestry;
- Provide better maps of non-fish bearing streams and other sensitive sites and structures to increase awareness of these sensitive areas that need protection among the aerial applicator community; and
- Employ GPS technology, linked to maps of non-fish bearing streams to automatically shut off nozzles before crossing non-fish bearing streams.

**Comment [AC33]:** Unnecessary verbiage. Saying "could include" means that the list is not exhaustive so don't need to repeat ourselves.

**Comment [AC34]:** Do we want to say something about more transparent notification process? This was a big issue raised in commenters and while I don't think we should hold OR to that for CZARA approval, it sure doesn't hurt to recognize the concern and encourage the state to do that in this forum.

*I think we should still consider something along these lines.*

**Comment [AC35]:** OR already has guidelines to minimize drift (see above para.) I think a few specific examples are needed here for the state to understand what additional specificity we're looking for.

*I still think it's important to provide more specific examples here.*

**Comment [AC36]:** This isn't something the state can do. This is a BMP it would recommend applicator adopt. Therefore, should it be an example under the first bullet rather than listed here?

*I still think this is an important distinction. See edit*

**Comment [CG37]:** Be specific with the name of the notification form.

**Comment [AC38]:** This isn't something the state can do. This is a BMP it would recommend applicator adopt. Therefore, should it be an example under the first bullet rather than listed here?

*I still think this is an important distinction. See edit*

If Oregon chooses a voluntary approach, the state would also need to meet the other CZARA requirements for using a voluntary, incentive-based programs as part of the state's coastal nonpoint program. This includes describing the process the state will use to monitor and track implementation of the voluntary practices, providing a legal opinion stating it has the necessary back-up authority to require implementation of the voluntary measures, and demonstrating a commitment to use that back-up authority.